

James A. Black (jblack@biopraxis.com; 858-452-2413)

Biopraxis, Inc.

10655 Sorrento Valley Road

Suite 200

San Diego, CA 92121-1609

Abstract

Groundwater accounts for 89.3% (708.0 million m³) of the media known to require remediation in DOE's Environmental Restoration Program. Only 150 groundwater sites are contaminated with organics alone, whereas 4,923 DOE groundwater sites require remediation for heavy metals and/or radionuclides, either alone or mixed with organics. MOP-UP® is a new approach for treating heavy metals and radionuclides in heavily contaminated, complex waters and wastewaters. FETC is supporting its development as a reactive medium for use in permeable barriers for in situ groundwater remediation. Under the baseline program, mercury, aluminum, cadmium, copper, lead, zinc, and nickel were taken to nondetectable levels (the minimum level of detection for mercury was 100 parts per trillion); 99.95% of the uranium was removed, leaving a residual concentration of 180 parts per trillion; and 98% of the barium was removed when MOP-UP® was used to treat a groundwater simulant containing 400ppm heavy metals, 88.1ppm VOCs, 1700ppm nitrate, and several other contaminants – at a pH of 4.2. The particulate MOP-UP® reagents can take up several times their own weight in heavy metals. They have also been shown to treat mixtures of anions and cations, including hexavalent chromium mixed with copper, cadmium, mercury, lead, nickel, and zinc; and to remove 98% of 20ppm total arsenic from groundwater containing 40% As(V), 10% As(III), and 50% organoarsenicals. During the past year, studies have focused on radionuclides. MOP-UP® has readily taken plutonium, americium, technetium, radium, strontium, and cesium to nondetectable levels in tracer-only solutions. Since the *starting* concentrations ranged from 0.0029ppb ⁹⁰Sr to 0.43ppb ²²⁶Ra for the cations and 22.5ppb for the anion pertechnetate, residual concentrations ranged from <0.029 parts per trillion ⁹⁰Sr to <4.3 parts per trillion ²²⁶Ra, and <0.225ppb ⁹⁹Tc. All detectable plutonium, americium, technetium, uranium, or cesium, and more than 98% of the strontium or radium, have been removed from a mixture containing a total of 122.1ppm VOCs (including methylene chloride, chloroform, acetone, 2-butanone, 1,1,1-TCA, TCE, PCE, and toluene). All detectable plutonium, americium, and uranium have been removed from mixtures containing 400ppm heavy metals and 1700ppm nitrates. All detectable uranium and 98% of the tracer-only plutonium have been removed from mixtures containing 122.1ppm VOCs, 400ppm metals, and 1700ppm nitrates. When incubated in such complex mixtures, the MOP-UP® reagents take up so much of the contaminants that they become visibly larger. Studies to determine the fate of the VOCs in such mixtures are now under way. The next step will be to select the optimum reagent formulation for treating Pathway 1 at the Oak Ridge S3 Ponds Area funnel and gate installation.